

AF #2800

AMENDMENT TRANSMITTAL LETTER

Docket No.
M4065.0226/P226

Application No.
09/484,437

Filing Date
January 18, 2000

Examiner
J. Mitchell

Art Unit
2822

Applicant(s): Tongbi Jiang

Invention: DIE ATTACH CURING METHOD FOR BGA PRODUCT

TO THE COMMISSIONER FOR PATENTS

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED					
	Claims Remaining After Amendment	Highest Number Previously Paid	Number Extra Claims Present	Rate	
Total Claims	22	- 22 =		x	0.00
Independent Claims	2	- 3 =		x	0.00
Multiple Dependent Claims (check if applicable)				<input type="checkbox"/>	
Other fee (please specify):					
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT:					

☒ Large Entity

☐ Small Entity

☐ No additional fee is required for this amendment.

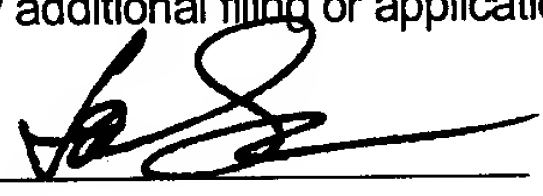
☒ Please charge Deposit Account No. 04-1073 in the amount of \$ 110.00.
A duplicate copy of this sheet is enclosed.

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Dated: March 27, 2002

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PATENT

Docket No.: M4065.0226/P226

9/Amend BAE
P. Wain
4-2-02

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Tongbi JIANG

Serial No.: 09/484,437

Filed: January 18, 2000

For: DIE ATTACH CURE METHOD
FOR SEMICONDUCTOR DEVICE

Confirmation No.: 9698

Group Art Unit: 2822

Examiner: J. Mitchell

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Commissioner for Patents
Washington, D.C. 20231

AMENDMENT AFTER FINAL REJECTION

Dear Sir:

Responsive to the Office action dated December 4, 2001, please amend the
above-identified application as follows:

Rewrite claims 1 and 12 and cancel claims 21-30 as follows:

31 Sub 7
C1
1. (Twice Amended) A semiconductor device comprising:

a solder mask;

a die; and

an adhesive layer between said die and said solder mask, wherein said adhesive layer comprises a material that remains voidless after outgassing from said solder mask and is at least partially curable at a temperature below about 100°C.

32 Sub 7
12. (Twice Amended) A semiconductor device comprising:

a solder mask;

a die;

electrical contacts on said solder mask and said die, each said contact on said die being wire bonded to a respective said contact on said mask, said electrical contacts being devoid of contamination caused by outgassing from said solder mask; and

an adhesive layer affixing said die to said solder mask, said adhesive layer comprising a material that is curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer.

Cancel claims 21-30 without prejudice or disclaimer to the subject matter recited therein.

REMARKS

Claims 1-20 and 31-32 are currently pending in the above-identified application. Claims 21-30, previously withdrawn from consideration, have been canceled and are being prosecuted in a related application. Claims 1-20 and 31-32 have been rejected. Claims 1 and 12 have been amended. Applicant respectfully requests reconsideration in light of the foregoing amendments and following remarks.

Claims 1-20, 31 and 32 stand rejected under 35 U.S.C. §103 as being unpatentable over the admitted prior art and Dershem et al. This rejection is respectfully traversed in light of the amendments and following remarks

Claim 1 recites a semiconductor device comprising “a solder mask”, “a die”, and “an adhesive layer between said die and said solder mask, wherein said adhesive layer comprises a material that remains voidless after outgassing from said solder mask and is at least partially curable at a temperature below about 100°C” (emphasis added). Claims 2-11 and 31 depend from claim 1. Claim 12 recites a semiconductor device comprising “a solder mask”, “a die”, “electrical contacts on said solder mask and said die, each said contact on said die being wire bonded to a respective said contact on said mask, said electrical contacts being devoid of contamination caused by outgassing from said solder mask”, and “an adhesive layer affixing said die to said solder mask, said adhesive layer comprising a material that is curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer” (emphasis added). Claims 13-20 and 32 depend from claim 12.

The “admitted prior art” relied upon by the Office action is a conventionally fabricated semiconductor device 10 that includes a die 12 affixed to a solder mask 18 through an adhesive layer 14. As further described in the Background of the Invention, conventional fabrication methods include curing the adhesive material with the solder mask through a high temperature cure for a short duration. For example, a curing step of one hour duration at 150°C causes outgassing of lower temperature volatile components of the solder mask, leaving behind the higher temperature volatiles to outgas at a later time during operation (specification page 1, line 22 – page 2, line 2). However, the cure time and temperature are insufficient (conventional adhesives cure at temperatures greater than 150°C – specification page 1, lines 13-14) to cure the adhesive material to such an extent that the later outgassing has no effect on the adhesive material, and thus later outgassing causes voids to be formed in the adhesive material. Further, later outgassing leads to contamination of electrical contacts, thereby decreasing the likelihood of a good bond therebetween. By utilizing an adhesive material which is curable at lower temperatures, curing of the adhesive material can be accomplished at the lower temperature, and any later outgassing from the solder mask does not affect the adhesive material.

Dershem et al. discloses adhesion compositions which can be completely cured quickly at elevated temperatures. Specifically, Dershem et al. teaches complete curing at around 200°C. See, Column 11, lines 49-50 (“The assembled parts were then cured on a heated surface ... controlled at 200°C. for two minutes”) and Column 13, lines 2-4 (“A test was conducted to test the adhesion performance of invention compositions following a one minute cure at 200°C”).

Neither the “admitted prior art” or Dershem et al., whether considered individually or in combination, teaches or suggests a semiconductor device including an adhesive layer that exhibits the property of being “at least partially curable at a temperature below about 100°C” as recited in claim 1. Further, neither the “admitted prior art” and Dershem et al., whether considered individually or in combination, teaches or suggests a semiconductor device including an adhesive layer that exhibits the property of being “curable at a temperature below about 100°C and at a temperature between about 20°C and about 50°C higher than a glassy temperature of said adhesive layer” as recited in claim 12.

For at least the reasons provided above, each of the presently pending claims is in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw all rejections and pass this application to issue.

Dated: March 27, 2002

Respectfully submitted,

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